TM

RMLD

Remote Methane Leak Detector

User's Manual

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HEATH CONSULTANTS

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Then, Now and Tomorrow

Notice

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Warnings

It is essential that users of this instrument read, understand, and follow the instructions for operation and maintenance, and the precautions contained in this manual to insure that the instrument is used in a proper and safe manner.

****Danger****

The visible green Spotter laser is a Class IIIa laser product. Do not stare into beam or view directly with optical instruments.

Fig. 1-1

****Caution****

No attempt should be made to repair the instrument. Should the instrument not work properly, or indicate a fault or warning, refer to the troubleshooting section of this manual.

****Warning****

Do not turn on the RMLD or use the instrument indoors if there is a potential, indication, or suspicion that an explosive level of gas is present.

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Overview

The **HEATH** Remote Methane Leak Detector (**RMLD™**) is a highly advanced technology, capable of detecting methane leaks from a remote distance. The RMLD is the first of a new generation of leak survey instruments that will greatly improve the productivity and safety of a walking survey.

With the RMLD it is now possible to survey areas that are hard to reach or not easily accessible. The RMLD does not have to be within the gas plume because it uses laser technology known as Tunable Diode Laser Absorption Spectroscopy. As the laser passes through a gas plume, the methane absorbs a portion of the light, which the RMLD then detects. This technology makes it possible to detect leaks along the sight line without always having to walk the full length of the service line.

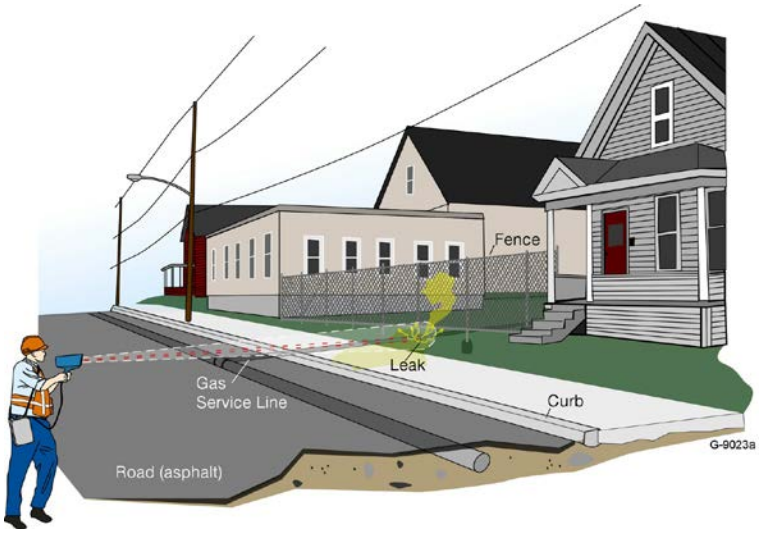

Fig. 1-2

Using laser technology, remote detection allows you to safely survey areas that may be difficult to reach such as busy roadways, yards with large dogs, fenced off areas, and other hard to access places.

It is designed to be selective to detecting methane only, and will not false alarm on other hydrocarbon gases. Gas concentration is calculated by the amount of Infrared light absorbed by the gas. Since gas is detected along the line of sight of the laser, the concentration is reported as Parts-per-Million-Meter (ppm-m). Thus, the RMLD measures the gas cloud concentration times the width of the gas cloud. Based on the local meteorological conditions, a given amount of gas escaping from the ground will produce a plume that varies in size and uniformity of concentration levels. The plume, by nature, is variable and dependent on the soil conditions, temperature, wind, and leak rate.

The RMLD consists of two main interactive components:

- Transceiver
- Control Module

Fig 1-3: The RMLD system consists of a Laser Emitter/Receiver and a Control Module

The Transceiver has two lasers. The Infrared laser is non visible and is continuously on while the unit is turned on. The operator turns on the visible green Spotter laser by depressing the trigger button.

The RMLD operates under a variety of environmental conditions including cold or hot weather and light rain. Its rugged design will stand up to normal field use and operating conditions. Its sensitivity or range is not affected by reasonable amounts of dust on the optics window.

The RMLD has built-in Self-test and Calibration functions that will assure that the instrument is operating properly. Using the calibration cell built into the carrying case, the operator can perform the self-test and calibration as part of a daily start up routine. While in operation, the RMLD continuously monitors several parameters to ensure that the instrument is functioning properly. Should any of these parameters go outside of the operational limits, an audible alarm will sound and a Fault/Warning error message will be displayed on the display.

A training video is provided with the instrument. It is highly recommended that the user view the video to learn basic techniques on surveying with the RMLD.

Chapter I
RMLD System Specifications

Detection Method:	Tunable Diode Laser Absorption Spectroscopy (TDLAS)
Measurement Range:	0 to 99,999 ppm-m
Sensitivity:	5 ppm-m at distance from 0 to 50 ft (15 m) 10 ppm-m or better from 50 to 100 ft (15 to 30 m)
Detection Distance:	100 ft (30 m) nominal. Actual distance may vary due to background type and conditions
Beam Size:	Conical in shape with a 22" width at 100 ft. (56 cm at 30 m)
Detection Alarms Modes	Digital Methane Detection (DMD): Audible tone relative to concentration when detection threshold exceeded. Adjustable Alarm Detection Threshold from 0 to 255 ppm-m Pure Tone: Continuous audio tone relative to concentration
System Fault Warning	Audible tone and indication on the display
Self Test & Calibration	Built-in Self-Test and Calibration function verifies operation and adjusts laser wavelength for maximum sensitivity. Test gas cell integrated with carrying case.
Compliance:	EMC (EN61000-6-2, EN6100-6-4) Pending
Laser Eye Safety: (CDRH, ANSI and IEC)	IR Detector Laser: Class I Green Spotter Laser: Class IIIa; Do not stare into beam or view directly with optical instruments.
Display:	Large easy to read backlit LCD (.75" Numeric)
Operating Temperature	0° to 122° F (-17° to 50° C)
Humidity	5 to 95 % RH, non-condensing
Enclosure:	IP54 (Water splash and Dust resistant)
Instrument Weight:	9 lbs (Transceiver 3 lbs, Controller 6 lbs) (4 kg; 1.3 kg, 2.7 kg)
Carry Case:	14 lbs; 34" x 9 ½" x 14" (6.4 kg; 86 cm x 24 cm x 36 cm)
Power Supply	Internal rechargeable Li-ion battery External Backup Battery pack with 5 C cells (Optional)
Battery Operating Life	8 hours at 32° F without backlight on (Internal battery)
Battery Charger	External, in-line, 110 – 240 VAC, 50 / 60 hertz universal type with charge indicator (8 hours maximum to full charge)
Shoulder Strap	Single over the shoulder padded strap Ergonomic dual strap and belt system (Optional)

RMLD System Components

This Chapter describes the features of the **RMLD**. Please refer to **Figure 1-4** for illustrations of individual parts.

Fig. 1-4: System Components.

Controller

The controller provides the user interface display, menu selection buttons, and external connections such as RS-232, battery charger port, external power supply port, headphone port, and on/off button.

Transceiver

The transceiver provides the laser launch for the infrared detection beam, visible green spotter laser, and spotter laser button. Harness hooks are provided to allow the unit to be suspended from the harness.

Carrying Strap

The RMLD is provided with a single carrying strap with shoulder pad. An optional dual strap harness is also available.

Battery Charger

The battery charger is provided to recharge the instrument after use. The charger is a universal 110 - 240 VAC, 50 / 60 hertz with charger indicator. Adaptors are provided to convert the style plug for different types of receptacles.

Instruction CD

The Instruction CD contains the following items:

1. Instruction Manual that provides instructions on the uses and operation of the instrument.
2. Training Video that illustrates proper use and techniques to fully utilize the instrument.
3. Additional **HEATH** product information.
4. HEATH contact information.

Carrying Case

The carrying case provides protection for the instrument during storage or transportation. The instrument should be kept in the case while not in use. Integrated into the carrying case is a calibration gas cell.

Headphone

Allows the operator to listen to the audible tones through a headphone instead of the external speaker.

Optional Accessories

Dual Shoulder Strap Harness

The dual shoulder strap harness provides extra comfort and support for carrying the instrument for an extended time. The built-in lanyard is used to carry the weight of the transceiver and provide additional stability and control of the unit while surveying. **HEATH** strongly suggests that this harness be used by personnel who use the instrument on a continuous basis to limit fatigue when holding the transceiver and to improve surveying technique.

Fig 1-5

External Power Supply

The external power supply is a back-up battery provided to extend the operating time of the instrument if the internal battery is not charged enough to run the instrument. This power supply contains 5 “C” batteries.

Fig 1-6

Chapter II
Battery Charging

Rechargeable Battery

The RMLD has an internal, rechargeable Li-ion battery that provides the main power to the instrument. This battery is designed to provide 8 hours of operating time when fully charged. The battery must be recharged between use to assure no interruption in use. The display features a battery life remaining indicator. Accuracy of this indicator is within 20% of the actual capacity. This indicator should be used only as a reference. Always start the day with a full charge to ensure a full day's use.

To maintain the best accuracy of the battery indicator, periodically deep discharge the battery and then fully charge the battery without any interruption. To deep discharge the battery, allow the instrument to run until it shuts itself off. This should also be needed if the indicator does not follow the actual charge, e.g., if the instrument stops operating while the battery indicator is reading that a charge remains or if the indicator is flashing

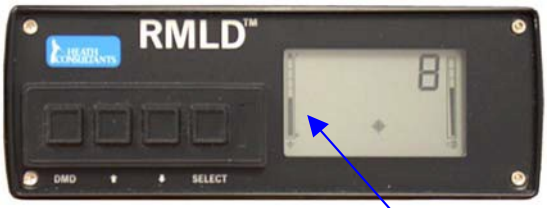

Fig. 2-1

****Note****

To obtain full battery capacity, charge the battery when the ambient temperature is above 50º F (10º C).

****Caution****

To prevent damage to the battery or electrical circuits, always plug the charger into a surge-protected outlet.

****Note****

The prolonged un-use of battery inside or outside the instrument can lead to battery chemistry being irreversibly damaged leading to permanent failure of the battery. It is recommended to have the battery go through at least one (1) charge-discharge cycle once every month if the battery is not being used for long periods of time.

When storing the instrument or the battery for more than a week, leave the battery charged up to about 40% and store at room temperature of about 60-70º F.

Battery Charger

The RMLD is provided with a universal AC battery charger. The plug of the charger can be changed to fit the type of receptacle used in your location.

Charging Procedure

To recharge the internal battery, perform the following procedure:

1. Turn the instrument off.
2. Plug the AC plug into a surge-protected outlet.
3. Plug the charger plug into the RMLD charger port.
4. A blinking green light indicates that the charger is charging.
5. Allow the unit to charge until the green indicator is on solid.
6. Unplug the charger.

Fig. 2-2

****Warning****

Only use the **HEATH** supplied RMLD battery charger to recharge the unit. Use of any other charger may cause severe damage to the battery or electrical circuits.

Chapter III
Operating the RMLD

This chapter provides information on the use of the RMLD. It provides an explanation of working with the menu, setting operational parameters, or enabling functions of the instrument.

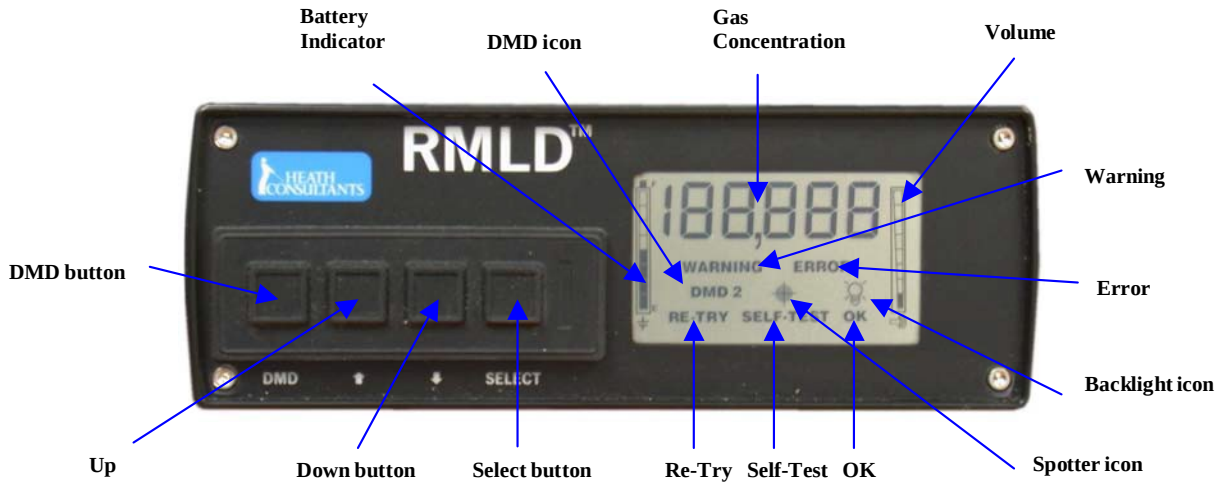

Fig. 3-1

Figure 1: RMLD front panel and display. (Note: for illustration, all the display icons are shown. During actual operation, only the icons associated with an active function will be displayed)

DMD button: press to turn on/off the DMD mode.
Up adjust button: press to increase a value or to acknowledge a user prompt.
Down adjust button: press to decrease a value.
Select button: press to scroll through the menu options.
Display:

- Battery Indicator: displays the amount of battery charge.
- Gas Concentration: displays the amount of gas in ppm-m. Over range is indicated by a 1-------.
- Volume: displays the volume level of the speaker and headphone
- Warning: icon indicating that the instrument is outside of an operation limit.
- Error: icon indicating that a fault condition has occurred; the instrument is no longer functioning properly.
- DMD: icon indicating that the DMD detection mode is on.
- Spotter: icon indicating that the spotter laser is enabled.
- Backlight: icon indicating that the backlight is on.
- Re-try: icon indicating that the self-test failed and should be performed again.
- Self-Test: icon indicating that the self-test mode is enabled.
- OK: icon indicating that the self-test successfully completed.

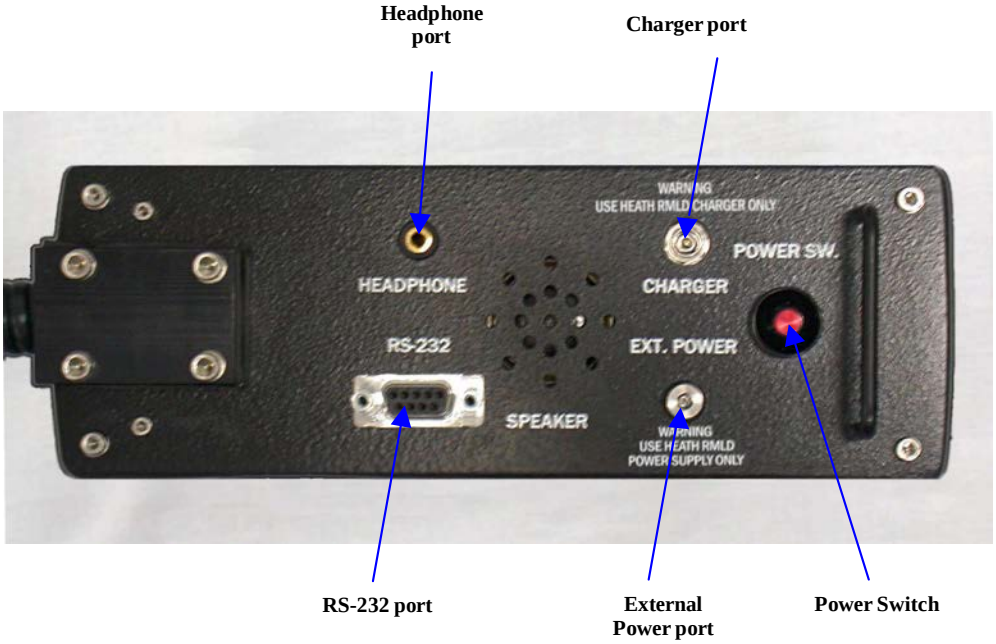

Fig. 3-2: RMLD rear panel

Headphone port: receptacle for the headphone plug.
Charger port: receptacle for the battery charger plug.
Power Switch: depress the switch to turn the instrument on/off.
Ext. Power: receptacle for the external backup battery plug.
RS-232 port: receptacle for a DB-9 connector for interfacing to a PC (Used for factory calibration purposes only).

Turning the RMLD On

Depress the Power Switch located on the rear panel. When the unit first turns on, the green Spotter laser will briefly flash, and the display will shortly show all of the icons. The display will then return to its run display mode showing the ppm-m reading. The Warning icon will also shortly display as the laser starts up. This warning should turn off after a few seconds. The instrument will turn on with the same settings (e.g., Alarm Detection Threshold, Spotter On, etc.) as when it was turned off.

****Note****

The Infrared detection laser is continuously on and the instrument is measuring the methane concentration while the instrument is on.

Turning On the Spotter Laser

****Caution****

The green spotter laser in under the control of the operator and is on only when the spotter trigger switch is depressed. While using the green spotter laser, be courteous to others by not shining it towards their eyes or causing vehicle drivers to be distracted. This type of laser is commonly sold in retail stores and used for business presentations. It is safe as long as the operator properly uses it.

****Danger****

The visible green spotter laser is a Class IIIa laser product. Do not stare into beam or view directly with optical instruments.

Fig. 3-3

Turning the RMLD Off

Depress the power switch located on the rear panel. The instrument will power off. The settings (e.g., Alarm Detection Threshold, Spotter On, etc.) will be automatically saved.

Using the Menu

The RMLD menu allows the operator to adjust certain operational values or to turn on/off other functions. The operator can change the following operational values:

1. Volume.
2. Alarm Detection Threshold.

The following functions can be turned on/off or enabled:

1. Self-Test.
2. Spotter.
3. Backlight.

By pressing the Select button, the Menu options are scrolled through in the following order:

- Self-Test
    i. Press Up button to initiate the Self-Test and Calibration
        1. Press the Up button to acknowledge user prompts (OK or Retry).

- VOL
    i. Press Up button to increase the volume level.
    ii. Press Down button to decrease the volume level.

- SPO
    i. Press Up button to enable or disable the Spotter laser.

- AL
    i. Press Up button to increase the Alarm Detection Threshold.
    ii. Press Down button to decrease the Alarm Detection Threshold.

Fig. 3-4

- BACLI
    i. Press Up button to turn on or to turn off the display backlight.

Fig. 3-5

Although the ppm-m readout will not be updating, the instrument will still operate properly while in a menu option other than the run display.

Using the DMD Mode

The Digital Methane Detection (DMD) mode is a highly sophisticated detection algorithm that greatly enhances the use of the RMLD. In most situations, the operator should survey with the DMD mode turned on. To turn on the DMD mode, press the DMD button (the DMD icon will appear on the display). This mode can only be activated while in the main survey screen.

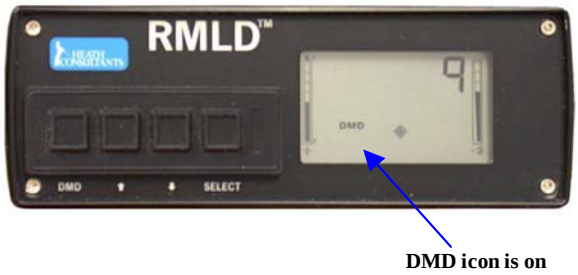

Fig. 3-6: DMD icon is displayed when in DMD mode.

While using the DMD, no sound will be heard until a detection of methane occurs. The pitch of the sound will be relative to the methane concentration. The higher the pitch, the stronger the methane concentration is.

A low-pulsating or continuous sound will indicate a warning due to an infrared laser low light level condition or instrument fault. The warning icon will also be displayed indicating that the light level is too low (See Long Range Scanning Pg. 23). The operator needs to move in closer to get in range.

Should the warning persist, it could be due to a fault in the instrument. Check the error code being displayed and follow the instructions in the troubleshooting guideline.

The DMD will indicate detection when the ppm-m exceeds the average background plus Alarm Detection Threshold level, or when the reading is excessive. While the low light

warning is sounding, the RMLD may still be able to detect very large gas concentrations, indicated by a high pitch tone.

The Alarm Detection Threshold controls the sensitivity of the DMD. The operator can adjust the Alarm Detection Threshold. Your company's survey procedure may require the use of a specific value or procedure to set it. Set the Alarm Detection Threshold such that the false detection rate is low, while not too high that leaks are missed.

To change the Alarm Detection Threshold, scroll through the Menu options until the "AL" option is displayed. Press the Up or Down button to increase or decrease the threshold. The higher the threshold setting is, the less sensitive the instrument becomes.

Using the Pure Tone Mode

The Pure Tone mode of the RMLD plays a continuous tone that is relative to the instantaneous concentration level. The higher the pitch of the tone, the higher the methane concentration level. No sound at all will indicate a low light level condition or instrument fault. Note that the pitch level increases as you scan at a further distance. This is due to the ambient amount of methane in the air.

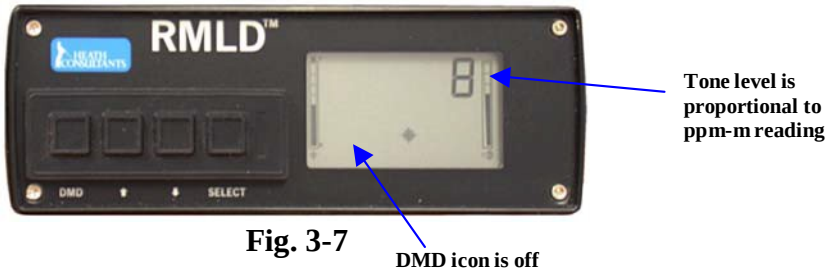

Fig. 3-7

The pure tone mode is most effective when used up close to help verify low level detections or to help isolate the highest gas concentration.

To verify a low level leak the following procedure should be used:

1. Stand back about 10 ft. from the leak with the wind to your back if possible.
2. Sweep the laser back and forth across the leak while maintaining a constant distance.
3. Listen for a consistent increase in tone level as the beam sweeps through the leak. Very small leaks will have just a slight increase in tone.

To isolate the spot with the highest concentration, the following procedure should be used:

1. Stand back about 10 ft. from the leak with the wind to your back if possible.
2. Sweep the laser starting from the up-wind side, in and around the leak area.
3. Listen for the highest tone level.
4. Change your angle slightly and re-scan the leak zone.

5. If the location with the highest pitch is consistent then the location of the leak is at that spot.
6. If the pitches are not consistent then keep working the area. The gas plume may be drifting around causing inconsistent readings. In some cases, the gas plume may be large enough that localization is not very accurate.

Self-Test and Calibration

The RMLD has a built-in function to perform a Self-Test and Calibration of the laser wavelength. The self-test feature should be used on a daily basis to ensure that the instrument is in proper working order. **HEATH** recommends that the self-test function be performed prior to the beginning of your survey day. Each Self-Test & Calibration should be recorded into a daily log. An example daily log has been included at the end of this manual for your convenience.

To perform the Self-Test and Calibration, the following procedure should be performed:

1. Remove the controller from the carrying case.
2. Turn on the instrument and allow it to warm up for 2 to 3 minutes.
3. Place the transceiver in its position in the carrying case; making sure it is all the way in place and flat.
4. Press the SELECT button until the SELF-TEST icon is shown on the display (Note: the Retry and OK icon are also displayed).

Fig. 3-7

5. Press the UP button to initiate the self-test. The number 255 will then be displayed.
6. When the OK icon is displayed, the instrument passed the self-test.
    a. If the RETRY icon is displayed then the instrument failed the self-test.

Press the UP button to return to the beginning of the SELF-TEST and refer to the next section: Calibration Override.

7. Press the UP button. This will initiate the calibration sweep of the laser wavelength. This takes about 45 seconds to complete and you will notice that the gas concentration readings will go up and down.
8. When the OK icon is once again displayed, the instrument has passed the laser calibration.
    a. If the RETRY icon is displayed the instrument failed the calibration. Press the UP button to return to the beginning of the self-test.
9. Press the UP button to acknowledge.
10. Press the SELECT button to scroll back to the run display.

What if the instrument failed the Self-Test and Calibration? Most often, the cause is due to the transceiver not being properly positioned in the case or the laser wavelength has drifted. Make sure the unit is in its proper position, all the way down, and flat. Note the gas concentration. It is typically about 1100 ppm-m, but must be between 500 and 2000 ppm-m. After rechecking the above, repeat the Self-Test and Calibration procedure above.

Calibration Override

Should the unit fail at step 6 due to initial low readings perform the following actions:

1. Ensure the instrument is still in the Self-Test menu from step 6 above.
2. Override the normal Self-Test function by pressing the DMD button. This will force the laser calibration sweep.
3. At the end of the first sweep, OK will be displayed. Press the UP arrow key again to restart the sweep.
4. At the end of this sweep, Self-Test OK will be displayed. Press the UP arrow and then SELECT to exit the Self-Test menu.
    a. If it fails, it will show RETRY, and the unit is not functioning properly. Contact **HEATH** for assistance.

****Note****

Laser wavelength drift is a normal characteristic of the RMLD. Normally the rate of drift is low and will not affect the Self-Test if performed on a regular basis. If the initial reading is low when placed in the case, and requires the use of the calibration override to force it through calibration, then the laser calibration was previously off. Survey work conducted with a unit out of calibration may need to be redone. If initial concentration readings are low on a regular basis such that the override must be always used, contact **HEATH** for assistance.

When the Self-Test fails. The following table may help to isolate the problem:

Cause	Corrective Action
Low signal strength or noisy	• Make sure battery is fully charged • Make sure that the unit is in its proper position, and all the way down and flat
Initial ppm-m too low or too high	• Make sure battery is fully charged • Make sure the unit is in its proper position, all the way down, and flat • Verify calibration cell is not broken • Use the Calibration Override
Laser adjustment failed	• Make sure battery is fully charged • Make sure that the unit is in its proper position, and all the way down and flat • Verify calibration cell is not broken

****Caution****

Should the instrument not pass after several attempts, do not use the instrument for survey work until the problem is corrected. Contact **HEATH** for further assistance.

Chapter IV
Surveying with the RMLD

A training video is provided with the RMLD, which demonstrates the best overview of techniques used. It is important to learn these techniques in order to properly survey and locate methane leaks. The purpose of the video is to familiarize a leak surveyor on the use of the RMLD. It does not provide basic leak survey training. Refer to your company's specific training and procedures for being qualified for leak surveying.

In order for the RMLD to detect a gas leak, three conditions must be met:

1. The gas plume concentration and size must be greater than the minimum sensitivity of the instrument.
2. The IR beam must pass through the plume.
3. The background target (i.e., ground, building, etc.) has to reflect the IR beam back.

Several factors influence the gas plume size and concentration. First, very low flowing leaks may produce small to non-measurable plumes. Also, surface types such as concrete will spread the leak and create spot leaks through surface cracks and holes. Weather conditions like high winds and higher temperatures will cause the plume to dissipate faster. The operator must consider these factors and their effects throughout the survey.

The most important aspect to using the RMLD is the proper control and aiming of the IR beam.

The first thing you will need to learn when surveying with the RMLD is to control the aiming of the laser and rate of sweeping. Radical or abrupt motion may cause the RMLD to give false detections due to rapidly changing distance or background that the laser detects. Radical or abrupt motion may cause the IR beam to not thoroughly scan the area.

Here are a few tips for walking along the main:

- Use a smooth sweeping motion.
- Keep the beam pointed out 15 to 20 ft. This allows for the beam footprint on the ground to be large enough to provide good coverage, and control over the path of the beam.
- Scan service tap and valve areas as you approach them.
- Target probable vent locations such as cracks, vegetation damage, etc.

While scanning the service line/meter where the location is known, keep these tips in mind:

- Use the advantage of the beam by sweeping wider around the line location.
- Work the beam up the line in an "S" pattern.
- Scan the meter area.
- Rescan down the line using the "S" pattern.

- Move in closer if the range is too far or ground elevation causes the beam to not come into contact with the ground (dark zones).

While scanning a service where the location is not known:

- Use an "X" pattern or similar pattern to thoroughly scan the area.
- Target typical vent areas i.e., along the street or sidewalk edges.
- Target locations where valves may be placed.
- Scan along the foundation of the structure.
- Move in closer if the range is too far or ground elevation causes the beam to not come into contact with the ground creating dark zones (shadow).

When scanning the meter, keep the following considerations in mind:

- Maintain at least 10 ft. from the meter so the beam width is not too small.
- Thoroughly scan the ground around the meter.
- Use the best angle to the meter that provides a good background behind the meter.
- If the meter is out in the open, or the angle is limited such that there is no background right behind the meter; scan the meter in a horizontal "Z" pattern maintaining a constant distance as you sweep across.

If a leak is located near or on the meter, these tips help to determine if the leak is underground or on the meter:

- Try to keep the wind to your back.
- Stand about 5 to 10 ft. from the meter.
- Use the Pure Tone to help pick out the strongest return.
- Start out aiming low on the ground.
- Work the beam up and around the piping (Note: The spotter laser is about 2.75" above the IR laser beam).
- If in doubt and if the leak is underground, bar hole the area.

Long Range Scanning:

The RMLD can detect leaks from up to 100 ft. away. Actual distance may vary due to target surface and environmental conditions. As the scanning distance is increased, the laser light level returned will become lower. As the maximum distance is approached, a "low laser light level" tone is heard. You will need to move in closer.

For best results when scanning at distances greater than 50 ft., it is important to slow down the scanning rate and take care in pointing the laser. When taking aim, use the spotter laser or the sighting marks on the side of the Transceiver to ensure proper scanning of the target area.

Be aware of the ground elevation. Scanning across the top of a knoll or past the edge of a structure can result in beam skips (a sudden change in distance) which may give you a false detection.

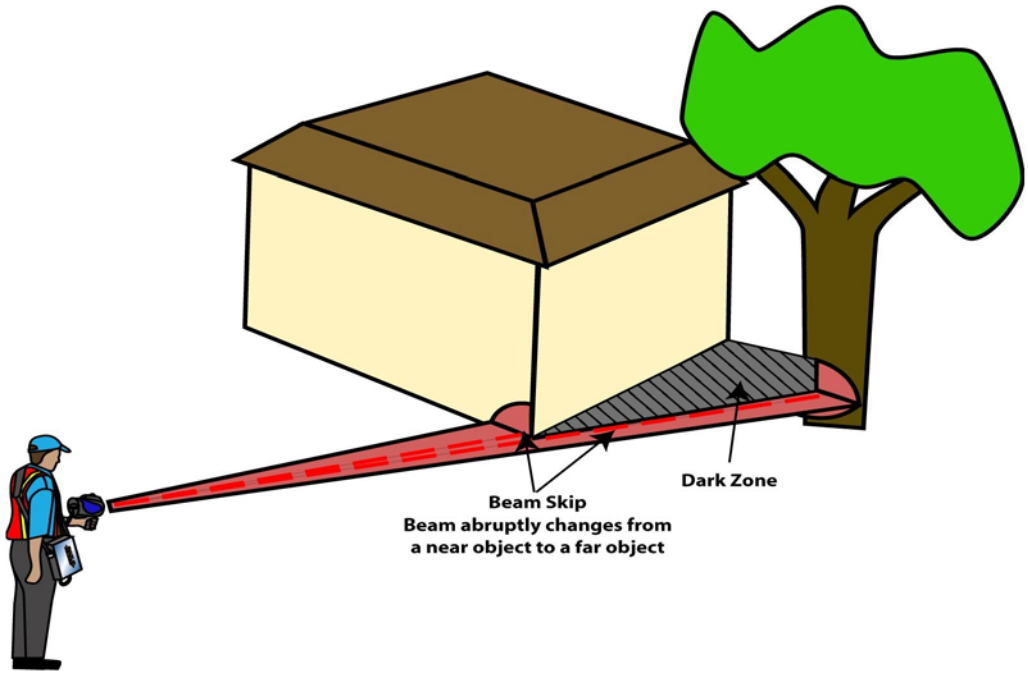

Fig. 4-1: Sudden change in distance may cause a false detection.

Obstructions or variations in the landscape can cause dark zones where the laser doesn't scan. Look for the best angle to thoroughly scan these areas. Scanning up a hillside may cause beam skipping or dark zones around the foundation of a structure.

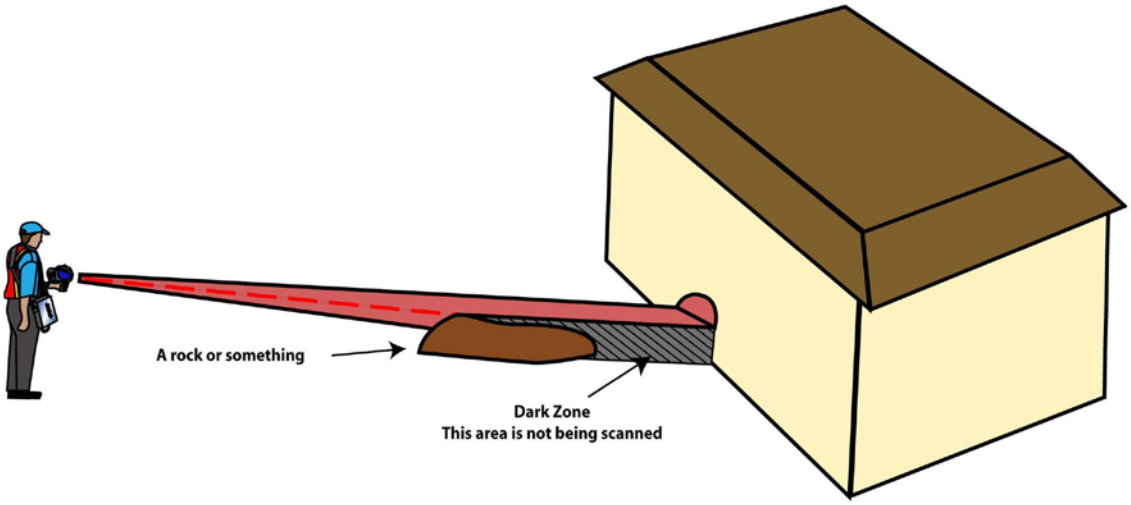

Fig. 4-2: Ground elevation change or obstructions in the line of sight will cause "dark zones" (shadows).

Dealing with False Detections

While using the DMD mode, several conditions may occur that will cause the algorithm to give a detection indication. The most common situations are:

- Abrupt or jerky motions causing the scanning distance to rapidly change.
- Overly strong returns due to strong reflectors.

The most common point that a false detection occurs is in the 50 ft (15 m) range. This is due to the beam footprint becoming very large. Abrupt motion, change in terrain, or distance to an object may cause the DMD to give a short low detection. To verify if the detection is due to a leak, pause at this distance, aim off to the side and re-sweep across the area to determine if gas is present.

Scanning from a long range to a short range will also minimize false detections.

Strong reflections off certain types of surfaces (e.g., black garbage bags, water droplets, glass, polished surfaces, stones, license plates, reflectors, etc.) may give a false detection. Rescan the area from a slightly different angle.

How Does the RMLD Measure Gas?

With the RMLD it is now possible to survey areas that are hard to reach or not easily accessible. The RMLD does not have to be within the gas plume because it uses laser technology known as Tunable Diode Laser Absorption Spectroscopy. As the laser passes through a gas plume, the methane absorbs a portion of the light, which the RMLD then detects. This technology makes it possible to detect leaks along the sight line without always having to walk the full length of the service line.

Fig. 4-3

The invisible Infrared (IR) detector laser beam is transmitted from the launch port. With a normal background, such as brick, concrete, and grass, it has a maximum distance of up to 100 ft. away (actual distance may vary due to surface condition).

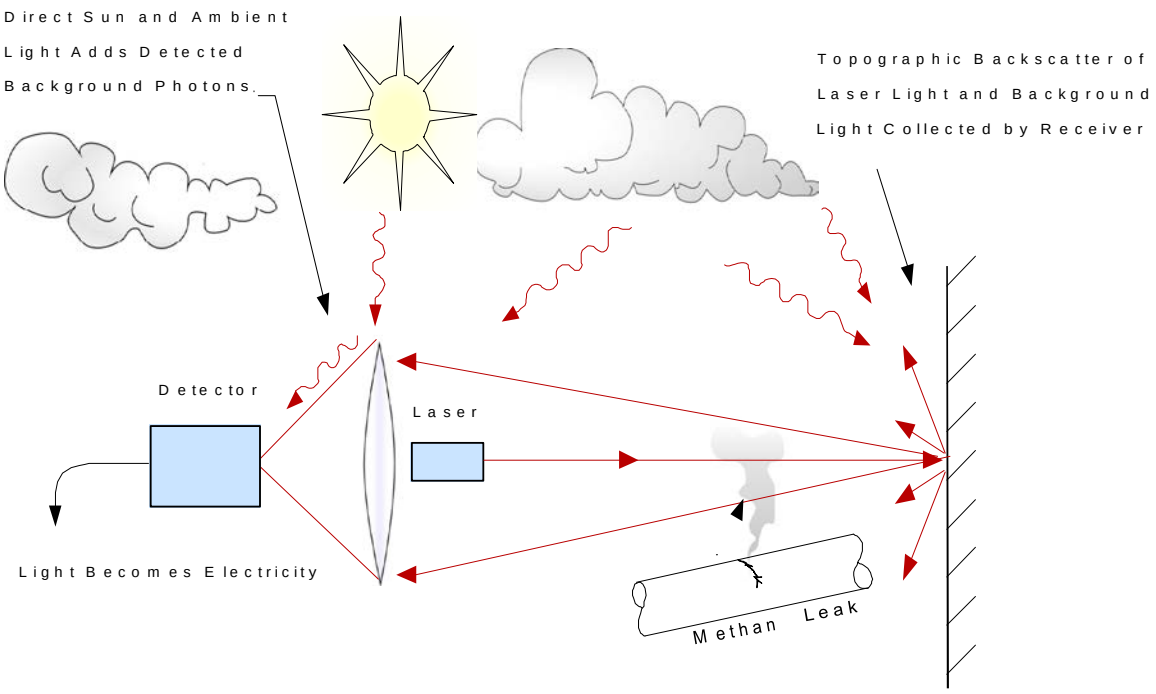

Fig. 4-4

To detect leaks, as the above illustration depicts, when the IR laser beam passes through a gas plume, and is reflected back, the reflected light is collected and converted to an electrical signal that carries the information needed to deduce the methane concentration.

The laser light is selective to methane, and will not false alarm on other hydrocarbons.

This signal is processed so that methane concentrations can be reported in parts-per-million-meter or ppm-m.

Ppm-m is the product of the methane concentration times the width of the plume. For example, if the leak is creating a gas cloud of 1000 PPM and is about ½ meter in width (the distance the IR beam passes through the plume). The RMLD will measure 500 ppm-m.

For another example, if the average concentration of the gas cloud is 20 PPM and is about 2 meter in width, the RMLD will measure 40 ppm-m, plus a background level of 15 ppm-m in this case, displaying a total value of 55 ppm-m.

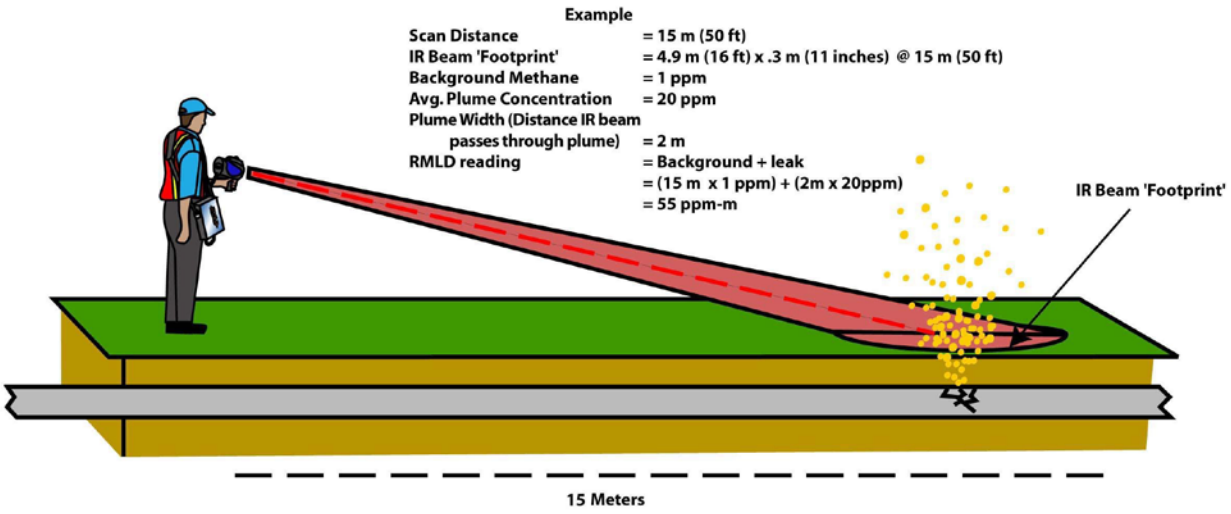
Example
Scan Distance = 15 m (50 ft)
IR Beam 'Footprint' = 4.9 m (16 ft) x .3 m (11 inches) @ 15 m (50 ft)
Background Methane = 1 ppm
Avg. Plume Concentration = 20 ppm
Plume Width (Distance IR beam passes through plume) = 2 m
RMLD reading = Background + leak
= (15 m x 1 ppm) + (2m x 20ppm)
= 55 ppm-m
IR Beam 'Footprint'
15 Meters

Fig. 4-5: The ppm-m reading is the product of the plume concentration times the distance the IR beam passes through the plume (plume width) in addition to any background gas. As the scan distance increases, the size of the IR beam "footprint" increases.

The IR beam width is about 22" at 100 ft. It is important to note that the laser beam "footprint" width and distance increases as the distance increases (see Figure 4-5). This is why it is much easier to detect leaks from a distance of 10 to 15 ft. and beyond.

Note

There is always a small amount of methane in the air. This natural methane background is also measured by the RMLD. The ppm-m reading will then increase as the scanning distance increases.

Note

The nature of a gas plume is highly variable. The above illustrations are intended to convey the basic theory. Some leaks may have a high surface concentration with little to no measurable plume above the surface.

Chapter V
Maintenance and Troubleshooting Information

Troubleshooting the Instrument

The advanced design of the RMLD makes it one of the most reliable leak survey instruments available. However, should you experience problems with the instrument or suspect that the instrument is not operating properly, do not use the instrument for leak survey work until the problem is resolved.

Only a qualified RMLD repair technician should attempt to repair or adjust the instrument. There are no user serviceable components in the RMLD that can be repaired or replaced.

Most often, a problem has a simple cause. The following table provides a list of common problems, cause and solution. Should you have a problem not listed or the solution doesn't work, please contact **HEATH** for further assistance.

Symptom	Probable Cause(s)	Solution
Readings are higher than normal at short range and lower than normal for long range.	• Laser calibration has drifted	• Run Self-Test
Concentration reading low and will not pass the Self-Test	• Laser calibration has drifted	• Run Self-Test and use the override function
Have to use Self-Test override each time the Self-Test is performed	• Laser calibration has drifted • Laser calibration drift rate is too high	• Perform the Self-Test on a daily basis • Contact **HEATH**.
Unit will not turn on	• Low battery	• Recharge internal battery, or • Use the External Power Supply
Keep getting a warning sound or icon when scanning	• Scanning at a distance beyond the RMLD range • Background surface is absorbing or reflection the light level	• Move closer to the target, or • Change angle to the target to get a better reflecting background • Check battery level and

	• Low battery	recharge if necessary
Excessive false detections while scanning at longer distances	• Scanning too fast • Alarm detection threshold set too low • Scanning at the range limit of the instrument	• Slow down the scanning rate. Pause at the long range and sweep towards you • Increase the Alarm detection threshold • Move in closer
Excessive false detections while scanning at closer distances	• Scanning too fast • Alarm detection threshold set too low	• Avoid making abrupt motions while scanning • Increase the Alarm Detection Threshold
Excessive false detections or loss of sensitivity	• Laser output not optimized • Alarm Detection Threshold set too high or low for conditions	• Perform Self-Test procedure • Check the Alarm Detection Threshold
Error icon or Warning icon on continuously	• Low battery • Moisture condensation on mirror due to rapid change in temperature • Internal component failure	• Check battery level and recharge if necessary • Allow for the temperature of the instrument to stabilize • Note error code and contact **HEATH**
Battery indicator does not show full charge after charging	• Battery not fully charged • Battery level calibration error	• Charge unit until solid green light on charger is on • Run unit until it shuts off, then fully recharge with out interruption
Battery indicator bars are flashing on and off	• Battery level calibration error	• Run unit until it shuts off, then fully recharge with out interruption

Maintenance

In order to maintain the RMLD in good working condition, the following maintenance should be performed as indicated:

Maintenance Item	Frequency
Clean outer surfaces with damp rag	As needed
Clean Transceiver window with damp KemWipe™ or equivalent none abrasive lens tissue	As needed to prevent dust or water stain build up
Self-Test and Calibration	Daily to insure that the instrument is functioning properly
Internal battery recharge	Recharge to full capacity after each use

Chapter VI
Service Information

Warranties and Warranty Repair

The RMLD is warranted to be free from defects in material and workmanship for one (1) year from date of shipment.

The warranty on authorized repairs in the Houston Factory Service Center (FSC) is ninety (90) days materials and labor. This repair warranty does not extend any other applicable warranties.

Our warranty covers only failures due to defects in materials or workmanship. It does not cover failure due to damage which occurs in shipment, unless due to improper packing. It does not cover failures, which result from accident, misuse, abuse, neglect, mishandling, misapplication, alteration, modification, or service other than the Houston FSC or other authorized repair center.

HEATH's responsibility is expressly limited to repair or replacement of any defective part, provided the product is returned to **HEATH** FSC or an authorized FSC, shipped pre-paid, and adequately insured. Return shipping and insurance will be at no charge to the purchaser.

HEATH does not assume liability for indirect or consequential damage or loss of any nature in connection with the use of any **HEATH** product.

There are no other warranties expressed, implied, or written except as listed above.

Obtaining Service

To expedite the repair of your instrument, please follow the following procedure:

1. Contact **HEATH** Customer Service at 1-800-HEATH-US to obtain a Return Authorization tracking number. Repairs can be significantly delayed until authorization is obtained.
    a. Specify your complete shipping and billing address.
    b. Specify the person and contact information to be contacted for repair and shipping authorization.
    c. Specify the instrument product name and serial number.
    d. Include a brief description of the problem you are experiencing.
    e. Specify the person and contact information to be contacted for additional information regarding the symptoms of the failure.
2. Package and ship the RMLD in its original carrying case.

Please specify the tracking number, product name, and serial number on all correspondence.

Glossary

Beam Skip: Occurs when the IR beam jumps between a near object and a far away object. This may cause a false detection.

Control Module: The portion of the RMLD with the keypad and display that clips onto a harness.

Dark Zone: An area not being scanned due to an obstruction. This may be an elevation change, the side of a building, behind a curb, etc.

DMD (Digital Methane Detection): An advanced detection mode which, when activated, will only alert the operator when there is a probable detection of methane.

Footprint: The surface area covered by the IR beam, increasing with distance. At 100 ft., this area is 22" in diameter when shined against a vertical wall.

Infrared (IR): A wavelength of light just outside the range of the visible spectrum.

Laser Calibration Drift: A normal characteristic of tunable diode lasers is that the wavelength calibration can drift slowly overtime. The RMLD has a built in Selt-Test/Calibration feature to automatically maintain proper calibration.

ppm-m (Parts Per Million Meter): The product of the methane concentration times the width of the plume.

Pure Tones: A mode that will emit a continuous tone relative to the concentration of gas detected.

Spotter Laser: The green, blinking laser attached to the top of the transceiver which guides the operator as to the location of the IR beam. This laser can be activated through the trigger located on the transceiver grip.

Transceiver: The hand-held portion of the RMLD, which contains the invisible IR laser transmitter/receiver and green spotter laser.

Tunable Diode Laser Absorption Spectroscopy: A method of gas detection that utilizes a laser that, when shined through a cloud of methane, will be partially absorbed by the gas which can be measured for gas concentration.

RMLD (NON-IS) PARTS LIST

Part Number	Part Description	Part Image
101517-0	Disc, Compact, RMLD	
101518-0	Assy, Charger, RMLD	
101520-0	Earphone Surround	
101522-0	Power Pack, External, RMLD ***FOR USE ON NON-IS ONLY**	
101528-0	Assy, Check Cell, RMLD	
102104-1	Shoulder Strap	
101529-0	Assy, Harness Control	

RMLD (NON-IS) PARTS LIST

Part Number	Part Description	Part Image
102458-0	DC to AC Inverters 150 W	
103150-0	Plug Adapter Set, US-Intl	

HEATH CONSULTANTS

1-800-HEATH-US
www.heathus.com

RMLD Daily Self-Test and Calibration Log

RMLD S/N _____

Date	Operator	Passed Self-Test?	Self-Test ppm-m Reading	Alarm Level	Notes

Declaration of Conformity

Manufacture's Name: Heath Consultants
Manufacture's Address: 9030 Monroe Road
Houston, TX 77061

Model: Remote Methane Leak Detector

Has been demonstrated to be in compliance with the European EMC directive (89/336/EEC), FCC 47 CFR, Part 15, Subpart B, Class A, and ANSI C63.4, and is in accordance with the following standards:

EN 61326-1		
Conducted Emissions	Class A	April 21, 2005
Radiated Emissions	Class A	April 21, 2005
FCC 47 CFR Part 15	Class A	April 21, 2005
ANSI C63.4	Class A	April 21, 2005
EN 61000-4-2	4/8kV	April 20, 2005
EN 61000-4-3	10V/m	April 20, 2005

Date of Issue: May 16, 2005

Signed by: (On File)
Graham Midgley
Heath Consultants CEO

Technical Support 1-800-HEATH-US
(1-800-432-8487)

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